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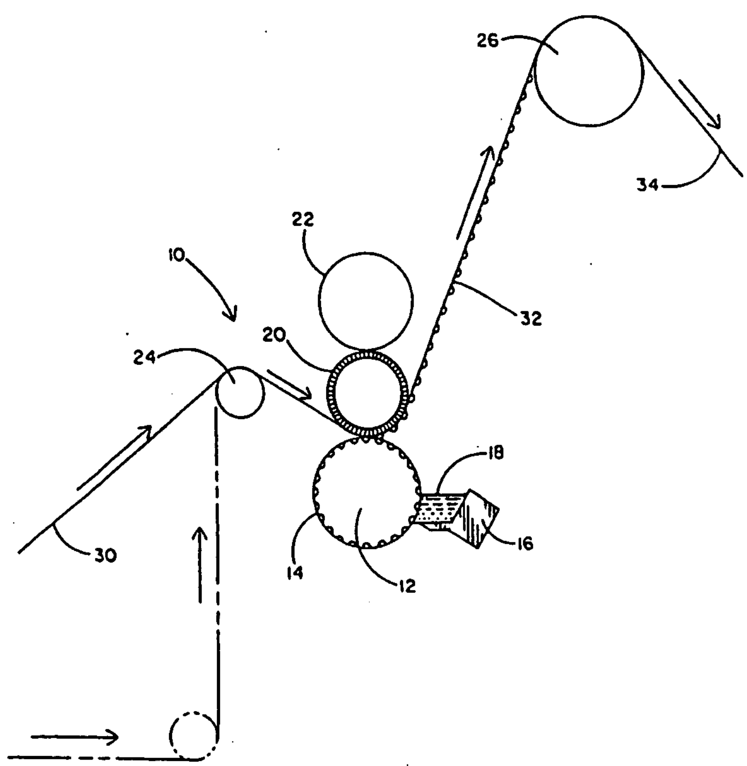
(54) Title: IMPROVED FUSIBLE BONDING TAPE AND METHOD OF MANUFACTURE THEREOF

(57) Abstract

An improved fusible adhesive tape, as well as an apparatus and method for manufacture thereof. The adhesive tape of the present invention is manufactured in accordance with a novel method, wherein a silicon-coated paper liner (30) is fed through a gravure printing apparatus (1) of the type which uses a heated container (16) for holding and applying the adhesive (18) to the gravure surface (14) of a gravure roller (12). The roller (12) is also heated to maintain the adhesive at its application temperature of about 450 degrees F. The liner (30), after being coated by the melted adhesive, is allowed to cool to ambient temperature, curing the adhesive and rendering the adhesive-coated liner material non-tacky and therefore rollable and cutable into tape configuration. The silicon coating on the paper liner (30) allows the adhesive material to be separated from the paper liner (30) when it is to be applied to the fabric.



BACKGROUND OF THE INVENTION

IMPROVED FUSIBLE BONDING TAPE AND METHOD OF MANUFACTURE THEREOF

FIELD OF THE INVENTION

The present invention relates generally to an improved fusion bonding tape of the type which may be used for adhering fabric in lieu of sewing and more specifically to an improved version of such tape and method of manufacture thereof, wherein a novel tape geometry permits tape melting at reduced temperatures and pressures, whereby ordinary home-style steam irons may be used in melting such tape on a fabric.

PRIOR ART

The use of adhesives in lieu of sewing to adhere fabrics to one another is not new. It is used most prolifically in the drapery or soft window coverings industry. The printed adhesive patterns on a supportive release liner can be utilized in the window coverings industry in various widths. They can be used as wide goods to bond to the back of textiles as interlinings or stiffeners for pleated shades and as valance stiffeners. Also, narrower webs as tapes can be slit to specified widths to be heat laminated to various products used in the window coverings industry. The tapes, when heat ironed onto selected fabrics or designs of textiles, can be utilized to manufacture both horizontal and vertical pulling soft window coverings including valances, curtains, dust ruffles and shades. The iron on adhesive laminated to the back of these tapes turns them into iron on systems rather than sewing systems for the fabrication of all types of window coverings.

The iron on adhesive when placed onto the back of the hook and loop strips, as well as the cotton or twill carrier for the metal snap fasteners, makes them into iron on systems rather than sewing systems. These fastening systems allow installation of soft window coverings without the use of rods or special devices for unusual designs and shapes. Soft window coverings have been previously made with film hot melt adhesives using a commercial steam iron and supporting pressure vessel. Heat and steam combine to reactivate the adhesive film to bond textiles for the purpose of eliminating sewing in the window coverings. Such adhesive materials'are generally useful for replacing sewing thread as an interconnection means in relatively low stress textile applications, such as drapery products including hems, pleats, smocking and shirring. The adhesive material is generally provided in the form of a tape which is non-tacky at room temperature, but which becomes extremely tacky and thus adhesive at elevated temperature and pressure, such as upon application of a boiler steam iron. One such prior art tape product is sold by a German company named Dohlemann GMBH, under the trademark DOFIX. In such prior art adhesive tapes, the adhesive is provided on a silicone-coated paper liner onto which melted adhesive is extruded and deposited as a film. After the adhesive has cooled, it may be peeled from the silicone-coated liner when it is applied to the fabric. A second application of sufficient heat to again melt the adhesive and steam pressure to drive it into the fabric weave results in reactivation of the adhesive. When it is placed between two fabrics, the adhesive will adhere to both, creating a fabric-to-fabric adhesion, which in many applications can be used as a substitute for sewing.

One of the principal disadvantages of such prior art thin film, hot melted adhesives is that reactivation requires the use of a commercial steam iron or other commercial level devices which can be used to supply sufficient high temperature and steam pressure simultaneously to adequately reactivate the adhesive. The high temperature and steam pressure requirements of such prior art adhesive materials render them less than satisfactory for use with conventional home style steam irons. High temperature requirements effectively deprive the homemaker of the opportunity to use such hot melt adhesive tapes unless such homemakers also invest in a commercial steam iron, including an attached commercial pressure vessel by means of a long steam hose, which may be ten to twenty feet in length. Unfortunately, such boiler style steam iron systems are expensive, cumbersome and generally not safe for use in a home environment. While standard home irons may work in some limited applications, the high heat and steam pressure requirement for most applications, particularly for use with polished fabrics that do not easily absorb the partially melted adhesive, makes it extremely difficult, if not impossible to use a standard home steam iron in conjunction with such prior art fusible adhesive tapes. Even commercial drapery workrooms which use meltable adhesive bonding must incur the additional cost and safety disadvantages of large, expensive commercial boiler-type steam iron systems.

There is therefore a need for an improved fusible adhesive tape which can be more readily melted at lower temperatures and thus effected by the lower heat and steam pressure of conventional steam irons that can be easily, conveniently and safely used in the home and in commercial drapery workrooms.

Relevant prior art known to the applicant includes the following:

U.S. Patent No. 4,880,683 to Stow is directed to a hot-tackifying adhesive tape. This patent is representative of the art generally found in this type of adhesive tape and provides more for a chemical formulation than a particular type of geometric pattern for the fiber elements. This reference merely provides for an acrylic polymer which is non-tacky at ordinary room temperature but at an elevated temperature, becomes tacky and adheres upon contact to various substrates.

U.S. Patent No. 2,349,710 to Evans is directed to adhesive fabric and methods of manufacturing such. The fabric includes a sheet having warp threads in one of the embodiments. It includes a layer of adhesive underneath at least some of the threads and a layer of adhesive on the surface of the fabric which is integral with the permeated layer. However, this generally directs itself to surgical fabrics and is not directed to the concept of heat treated adhesive used as drapery tape.

U.S. Patent No. 3,232,291 to Parker is directed to surgical adhesive tape and bandages. FIGs. 4-7 and 9 appear to show a diamond-shape before and after stretching. FIG. 4 shows a woven fabric cut on the bias. When the woven fabric is stretched on the bias it extends in one direction and contracts in the transverse direction. Similarly, the same type of action for the fabric is shown in FIG. 7. As stated in the specification, the knit cloth may be provided with adhesive by saturating it with an adhesive mass which may be softened or liquified by heat or solvent. This patent does not provide for

the drapery tape tackified by heat.

U.S. Patent No. 4,234,649 to Ward is directed to a binder material seam which includes a grid construction for a pressure sensitive adhesive for adhering a workpiece to a holding surface.

U.S. Patent No. 3,988,192 to Landis et al is directed to a method for tabling draperies. The method includes the placement of the drapery material on the table where it is secured. A joining apparatus moves across the edge of the drapery which is to undergo a crinoline bonding step. A feed roll dispenses a crinoline strip and a second feed roll dispenses an adhesive filament which is fed between the crinoline and the drapery material. A heater directs warm air over the crinoline in order to liquify the adhesive and join the crinoline and the material in a bond.

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SUMMARY OF THE INVENTION

The present invention comprises an improved adhesive hot melt tape and method of manufacturing such tape. The tape allows the use of a home steam iron for reactivation of the adhesive, thereby making it possible for homemakers and commercial drapery professionals to use such tape in lieu of sewing, such as for fabricating their own soft window coverings, but at lower cost and with improved safety. More specifically, the present invention comprises an adhesive hot melt tape wherein the adhesive is formed in a unique pattern which provides a substantially greater surface area for steam and heat of a conventional home steam iron to reach the adhesive surface for the purpose of reactivation. Thus, the invention provides effective fabric adhesion with reduced levels of heat and steam as compared to prior art tapes. The unique tape of the present invention comprises a uniform pattern of copolyamide adhesive which is gravure printed onto a silicone release liner using a gravure surface configuration of peaks and valleys. The peaks on the gravure surface produce open surface areas on the liners which remain void of adhesive. Unlike the prior art hot melt adhesive film which is produced by an extrusion process and results in a homogenous flat film, the cross-hatch gravure printing fabrication technique of the present invention provides an alternating uniform pattern of peaks and valleys of adhesive that is substantially thicker than the flat film of the prior art adhesive tape, but is nevertheless designed to expose a much greater working surface area to permit reactivation and fusing to fabric substrates at a lower temperature. The lower heat required to reactivate and fuse the adhesive tape of the present invention is also

significantly advantageous relative to the prior art adhesive tapes because it can be utilized on heat sensitive and delicate fabrics which can be otherwise damaged by the application of higher heat required by prior art adhesive tapes. Furthermore, unlike the prior art adhesive tape, the adhesive tape of the present invention does not form a solid continuous film of adhesive on the underlying fabric when it is reactivated, and thus provides a much softer feel of the resulting adhered fabric. This characteristic is especially important in the drapery or window coverings industry. Furthermore, rougher and coarser surfaces of textiles can be bonded with greater ease and with improved bond strength because of the unique high surface area pattern and thicker geometry of the present invention as compared to the prior art.

All hems which have been machine or hand sewn can be made with the use of a narrow width adhesive film, typically .400 inch to .500 inch in width. The adhesive film is attached to a silicone-coated release liner for the ease of handling and transfer to the materials to be hemmed. The adhesive is transferred by placing the shiny adhesive face down onto the material to be hemmed. Ironing on the silicone release paper side transfers the adhesive web-tape to the textile material. The silicone release paper is then removed by pulling it away from the textile material. The adhesive remains on the textile material to be bonded at the hem. The second textile material is then positioned over the adhesive on the first substrate and bonded in place with heat and steam as required.

The bonding process for the copolyamide adhesive web requires a home-type continuous steam iron with a minimum of 1100 Watts. Typically, a home steam iron at the "cotton setting" will require a 10 second dwell at the bond point to fully fuse the two textiles at the hem. Different types of textiles require different temperatures and time durations at the bonding point dependent upon thickness, weight and porosity. Also, some textile fabrics are more heat sensitive than others. A thin and porous material requires less bond line time. A polyester requires a lower temperature and somewhat more time to make the bond at the hem. When fusing the adhesive at the hemming or bonding point, it is important to apply downward pressure on the iron and press firmly. It may be necessary to increase fusing time and pressure for heavier fabrics.

The fabrication method of the present invention uses a novel gravure printing technique which is believed to be extremely innovative in application for fabricating adhesive tapes of the type herein disclosed. More specifically, in the method of the present invention, a melted copolyamide adhesive is applied at high temperature to the rotating surface of a gravure roller. A silicone-coated paper backing or release liner material is applied to the roller under pressure in a manner similar to gravure printing techniques. The melted adhesive adheres to the silicone-coated paper in a pattern dependent upon the geometry of the gravure roller surface. In the preferred embodiment of the present invention the gravure surface comprises a plurality of truncated four-faced pyramids, the dimensions of which may be selected to optimize the tape adhesive character to accommodate various fabric adhesion applications. The adhesive-covered, silicone-coated paper backing is allowed to cool as it is fed away from the gravure

roller until it reaches substantially ambient temperature wherein the adhesive is in a cured solid state and of a non-tacky character. The rolled adhesive and backing can then be cut perpendicular to the axis of the roll into a tape configuration of selected width whereby it may be more readily and conveniently applied to the fabric at a joint, for example, and subsequently reactivated by application of heat and steam.

OBJECTS OF THE INVENTION

It is therefore a principal object of the present invention to provide an improved adhesive film in the form of a tape that may be used advantageously for bonding textiles, such as for eliminating sewing in window coverings; the improvement comprising a novel high surface area, greater thickness, patterned tape configuration which permits reactivation of the adhesive at a lower temperature as compared to prior art extruded adhesive tapes.

It is an additional object of the present invention to provide an improved adhesive tape for use in bonding fabrics and which provides a low heat reactivation configuration which permits the use of conventional home steam irons as opposed to higher heat commercial steam iron systems which would otherwise be required to reactivate adhesive tape of prior art configurations.

It is still an additional object of the present invention to provide an improved low temperature reactivation adhesive tape for bonding fabrics and the like, the tape being manufactured by a gravure roller process which permits the selection of a variety of different geometrical designs of the tape configuration for increased surface area, lower heat reactivation,. improved bonding strength and a softer feel for the adhered fabric, as compared to prior art film melted adhesion tapes.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and advantages of the present invention, as well as additional objects and advantages thereof, will become more apparent hereinafter as a result of a detailed description of a preferred embodiment when taken in conjunction with the following drawings in which:

FIG. 1 is a schematic illustration of an apparatus which may be used for carrying out the method of manufacturing the present invention;

FIG. 2 is a plan view of the resulting adhesive tape of the present invention;

FIG. 3 is a plan view of the gravure roller configuration of the present invention;

FIG. 4 is an enlarged view of a portion of the gravure roller pattern or geometry that may be used in the present invention;

FIG. 5 is a cross-sectional view of the gravure roller geometry, taken along lines 5-5 of FIG. 4; and

FIG. 6 is a cross-section view of the gravure roller and release liner illustrating the interaction therebetween during fabrication.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring first to FIG. 1, there is shown therein a fusible adhesive tape fabrication apparatus 10, which currently constitutes the best mode of carrying out the method of the present invention. Apparatus 10 comprises a gravure roller 12, upon which there is provided a gravure surface 14, the details of which, for a preferred embodiment thereof, will be discussed hereinafter. Gravure roller 12 is mounted immediately adjacent an adhesive heating container 16 which contains a melted adhesive 18 for application to the surface of gravure roller 12. The adhesive polymer which has been used to gravure print the adhesive patterns is a copolyamide. The raw adhesive is preferably dried to maintain uniformity in moisture content for handling in granular form. It preferably contains optical brighteners which help prevent damage to the final adhesive bond from incident sunlight. The adhesive should be steam sensitive and should polymerize upon reactivation in the presence of steam. The melting point of the adhesive is preferably in the range of 225 - 235 degrees F. Its density should be greater than 1.0 and its viscosity at 350 degrees F. is 152,500 centipoise. Apparatus 10 also comprises an elastic roller 20, a chill roller 22, a feed roller 24 and a chill roller 26.

A release liner, or backing 30, which may consist of a silicone-coated paper material, is provided in the form of an elongated roll (not shown) having a width commensurate with the length of gravure roller 12 and having a length which is dependent upon the amount of adhesive tape to be fabricated during one operation of the apparatus 10. In typical

applications, paper roll lengths of approximately 20,000 feet are common. The release liner that is used as a carrier for the adhesive patterns is a bleached parchment paper which has been silicone-coated on the surface. The weight of the coated paper is about 30 pounds per 3,000 square feet.

As seen further in FIG. 1, silicone-coated paper or release liner 30 is fed to roller 24 which, as shown by means of phantom lines in FIG. 1, may receive the liner from any of a plurality of directions, including a diagonal direction or a horizontal direction. Feed roller 24 positions the release liner 30 at an appropriate angle for application to the gravure roller 12. The release liner 30 is fed between the gravure roller 12 and the elastic roller 20, the latter of which may have a rubber surface or other readily deformable material surface for assuring a firm engagement between the release liner 30 and the gravure surface 14 of roller 12. Elastic roller 20 is rotated by roller 12. The rate of application of adhesive 18 to the gravure surface 14, as well as the rate of rotation of the various rollers and the rate of feed of release liner 30 through the apparatus 10, may all be readily adjusted to assure that the proper quantity of adhesive is delivered to the release liner 30. Such rates of application and rotation are well-known in the gravure printing process art and therefore need not be disclosed herein in detail. The rates of feed and rotation can be readily adjusted to accommodate the viscosity of the adhesive and the desired adhesive tape quality and that such variations are well-known in the art.

In a preferred embodiment of the invention, both the adhesive container 16 and gravure roller 12 may be heated to a temperature of about 450 degrees F. by hot oil, which may be pumped through the wall of container 16 and the interior of roller 12, adjacent the surface 14 thereof, in a well-known manner. However, other forms of heating the adhesive and maintaining the adhesive in a melted condition upon the surface 14 of roller 12, may be readily utilized in carrying out the method of the present invention.

The melted adhesive-coated liner 32 is conveyed to a chill roller 26, the latter being maintained at ambient temperature, thereby allowing the hot adhesive-coated liner 32 to cool sufficiently to cure the adhesive and solidify it by the time the liner reaches chill roller 26, wherein the finished product comprises a cooled adhesive-coated liner 34, shown in the upper right-hand corner of FIG. 1.

One example of a finished product of the fusible adhesive tape of the present invention is shown in FIG. 2. As seen therein, the resulting adhesive tape 28 comprises a cross-hatch configuration or pattern in which lines of adhesive cross each other at ninety degree intersections. The lines of adhesive are oriented diagonally at an angle of approximately 45 degrees relative to the travel direction of the coated liner 34 in apparatus 10 of FIG. 1. Of course, it will be understood that the pattern of the adhesive tape 28 is entirely dependent upon the pattern of gravure surface 14 of roller 12 and may be readily varied from that shown herein as the preferred embodiment. The actual gravure surface 14, necessary for producing the pattern of adhesive tape of FIG. 2, is shown in FIGs. 3 through 6 which will now be discussed in more detail.

As seen in FIGs. 3, 4, 5 and 6 the gravure surface 14 of the preferred embodiment of the present invention comprises a plurality of pyramid-shaped protrusions 38 extending from an underlying base 36. Each such protrusion 38 is formed from a plurality of diagonal walls 40 of symmetrical configuration and terminating in a flat plateau 42 at the end opposite the base and parallel thereto. The intersection of the diagonal walls 40, closest to the base 36, forms a network of valleys 44 and it is these valleys 44 which collect the adhesive in the manner shown in FIG. 6.

In a preferred embodiment of the gravure surface 14, the dimension A, shown in FIG. 4, is equal to 1,058 microns, dimension B, shown in FIG. 4, is equal to 380 microns, dimension C is equal to 245 microns and dimension D is equal to 250 microns. However, it will be understood that the specific dimensions, as well as the overall shape and geometric configuration of the gravure surface may be readily altered, while still achieving the overall goals and objectives of the present invention.

It will now be understood that what has been disclosed herein, comprises an improved fusible adhesive tape, as well as an apparatus and method for manufacture thereof. The tape is fabricated by a novel gravure printing process which has been adapted for fabricating a fusible adhesive tape. The fusible adhesive tape manufactured in accordance with the method of the present invention provides significant advantages over the prior art fusible adhesive tape. Not the least of such advantages is a lower heat requirement for reactivation of the adhesive upon a fabric. This makes it possible for the average

homemaker to use an ordinary homestyle steam iron, thereby making it unnecessary to employ commercial level equipment for activating the adhesive. Furthermore, the reduced heat requirement for the adhesive of the present invention, reduces the probability of damaging the fabric, especially fabrics which are sensitive to heat. Furthermore, the novel pattern configuration of the adhesive tape of the present invention makes the reactivated adhesive less likely to interfere with the flexibility of the fabric onto which it is adhered. The improved tape of the present invention is therefore highly advantageous for window coverings use, particularly where it is important to preserve the drapability and aesthetic drape-like look of window coverings.

The adhesive tape of the present invention is manufactured in accordance with a novel method, wherein a silicone-coated paper liner is fed through a gravure printing apparatus of the type which uses a heated container for holding and applying the adhesive to the gravure surface of a gravure roller. The roller is also heated to maintain the adhesive at its application temperature. The liner, after being coated by the melted adhesive, is allowed to cool to ambient temperature, curing the adhesive and rendering the adhesive-coated liner material non-tacky and therefore rollable and cutable into tape configurations. The silicone coating on the paper liner allows the adhesive material to be separated from the paper liner when it is to be applied to the fabric.

In a preferred embodiment disclosed herein, the gravure surface that is used to fabricate the novel adhesive tape of the invention, comprises a regular pattern of pyramid-shaped truncated protrusions which produce an adhesive tape having a cross-hatched configuration of selected dimensions. However, the present invention may be readily altered by simply changing the pattern of the gravure surface to provide geometric patterns of other shapes which are still conducive to lower heat reactivation and still provide the other advantages of the present invention recited herein.

Those having skill in the art to which the present invention pertains will now, as a result of the applicants teaching herein, perceive various modifications and additions which may be made to the invention. By way of example, the precise formulation of the adhesive disclosed herein, as well as the precise gravure surface configuration and the resulting geometric pattern of the adhesive tape of the present invention may be readily altered while still achieving the objectives and advantages of the invention. Accordingly, all such modifications and additions are deemed to be within the scope of the invention, which is to be limited only by the claims appended hereto.

I claim:

CLAIMS

1. An improved fusible adhesive tape of the type used for bonding fabrics by being applied thereto with sufficient heat to remelt the adhesive onto the fabrics; the improvement comprising:

an adhesive tape pattern of selected geometrical configuration having alternating adhesive and voids for increasing the surface area of said adhesive and decreasing the effective melting temperature of said adhesive tape.

2. The improvement recited in claim 1 wherein said geometrical configuration comprises intersecting diagonal lines of adhesive forming polygon-shaped voids therebetween.

3. The improvement recited in claim 2 wherein said diagonal lines intersect at right angles and said voids are four-sided.

4. The improvement recited in claim 1 wherein said adhesive has a melting temperature in the range of about 225 degrees F. to 235 degrees F.

5. The improvement recited in claim 1 wherein said tape further comprises a release liner made of silicone-coated paper.

6. The improvement recited in claim 2 wherein the density of said diagonal lines of adhesive on said tape is 22 per inch.

7. The improvement recited in claim 2 wherein the density of said diagonal lines of adhesive on said tape is 35 per inch.

8. The improvement recited in claim 2 wherein the density of said diagonal lines of adhesive on said tape is 54 per inch.

9. The improvement recited in claim 1 wherein said adhesive is a copolyamide polymer.

10. A method for fabricating a geometrically patterned fusible adhesive tape of the type used for bonding fabrics by being applied thereto with sufficient heat to remelt the adhesive onto the fabrics; the method comprising the steps of:

a) providing a gravure printing apparatus comprising a gravure roller;

b) preparing the exterior radial surface of said roller in accordance with the desired geometrical pattern of said tape;

c) feeding a release liner into said gravure printing apparatus, said liner being made of a material for receiving a melted adhesive, but readily releasing said adhesive after it solidifies;

d) applying a melted adhesive to said surface of said gravure roller for coating said release liner with said adhesive in accordance with said geometrical pattern;

e) withdrawing said adhesive-coated release liner from said apparatus while allowing said adhesive on said liner to cool and solidify.

11. The method recited in claim 10 wherein step b) further comprises the steps of:

b1) providing said surface with a plurality of regular protrusions forming peaks and valleys, said valleys holding said melted adhesive and said peaks forming non-adhesive voids on said release liner.

12. The method recited in claim 10 wherein step d) further comprises the preparatory step of melting said adhesive at a temperature in the range of about 450 degrees F..

13. The method recited in claim 10 wherein step c) further comprises the preparatory step of preparing said release liner by silicone coating a bleached parchment paper.

14. The method recited in claim 11 wherein step b1) further comprises the step of configuring said protrusions to form a geometrical adhesive tape pattern having intersecting diagonal lines of adhesive and polygon-shaped voids between said lines.

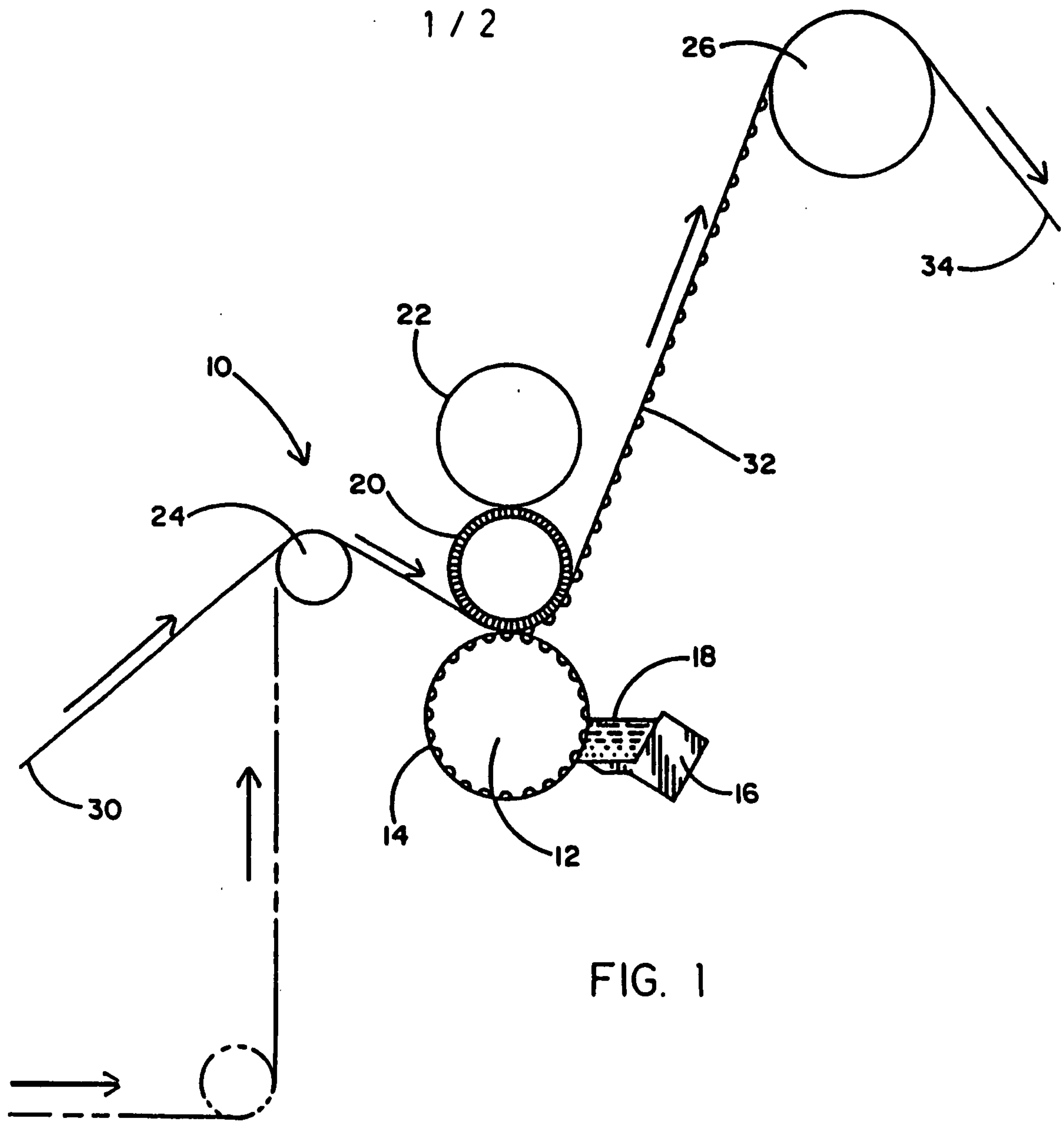

FIG. 1

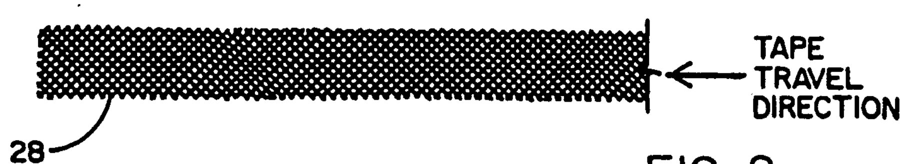

FIG. 2

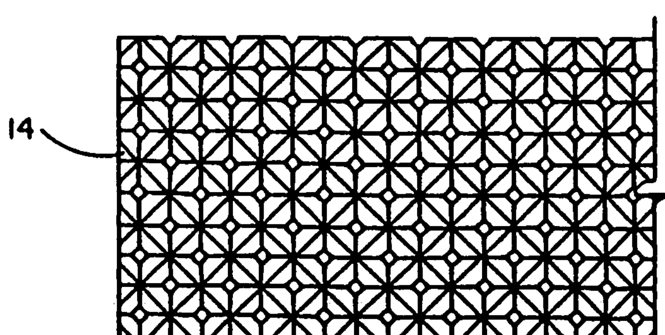

FIG. 3

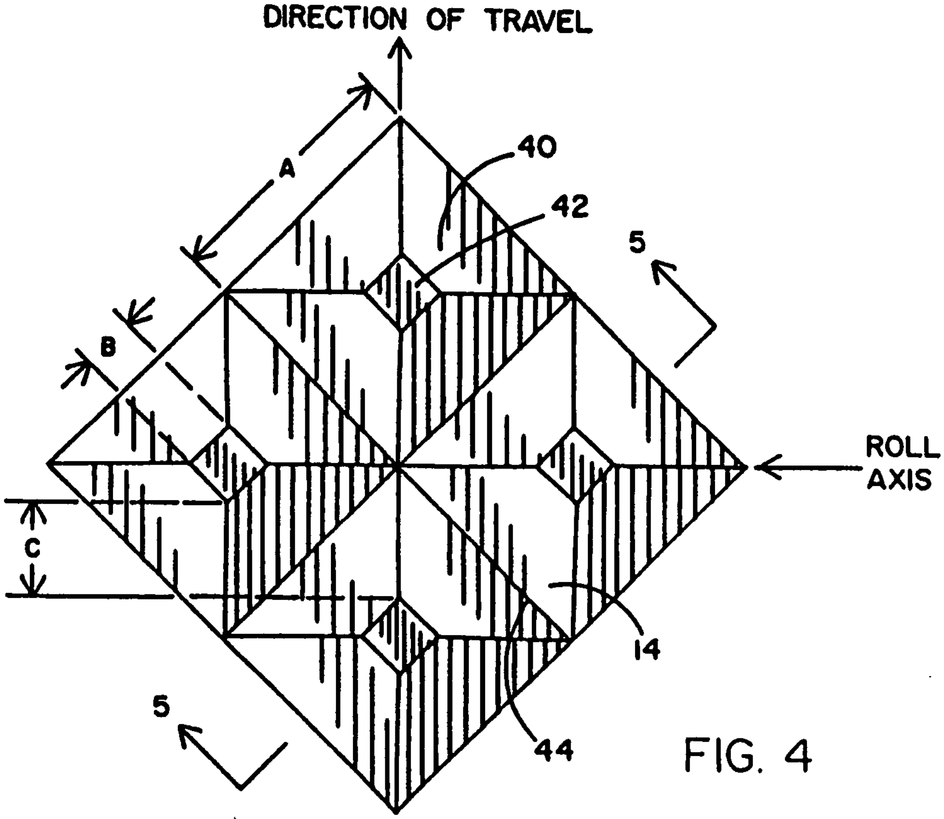

FIG. 4

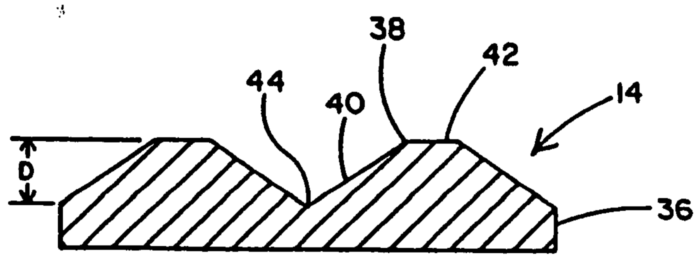

FIG. 5

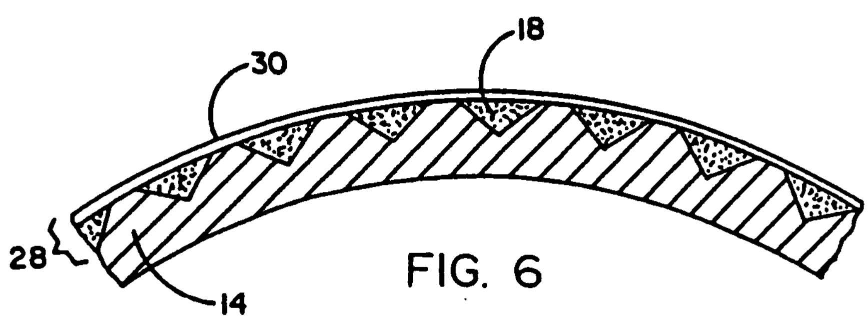

FIG. 6